
Chapter 4. No-Build Conditions and Analysis

4.1 Introduction

This chapter describes the future no-build analysis scenario. The no-build scenario consists of forecast 2018 and 2040 volumes as described in the previous chapter and improvement projects within the US Route 1 corridor that were either under construction or funded at the time of this study. It is assumed that no other roadway improvement would be made.

4.2 Planned & Programmed Projects

There are a number of projects in the vicinity of the study area that are programmed and funded to be in place before 2018. The following describes the projects were assumed to have been completed.

4.2.1 US Route 1 Improvements from Joplin Road to Brady's Hill Road

This project widened US Route 1 north of Joplin Road (outside study area) from four to six lanes. Specific improvements completed in 2012 include:

- Addition of an additional westbound through lane on Fuller Road
- Addition of an additional southbound left-turn lane toward Marine Base Quantico
- Construction of a multi-use path on west side and a sidewalk on the east side of US Route 1

4.2.2 Fuller Road/Fuller Heights Road Intersection Improvements

This project will widen Fuller Road, which is the entrance road serving the Marine Corps Base Quantico (MCB Quantico), the Town of Quantico, and communities adjacent to the Base. The improvements will:

- Convert Fuller Road from the existing four-lane undivided roadway to a four-lane divided roadway, creating a third westbound lane on Fuller Road west of Fuller Height Road that will terminate as a right-turn only lane at Route 1
- Relocate Fuller Heights Road to the east to increase the spacing between the intersections of Fuller Road with US Route 1 and Fuller Heights Road
- Widen the southbound Fuller Heights Road approach to the intersection to two lanes (one left-turn lane and one right-turn lane)

4.2.3 Heritage Center Parkway

This project will create a second access point to US Route 1 from the United States Marine Corps Heritage Center, which is planned to undergo expansion. The improvements will:

- Convert the existing access point to US Route 1 into a left-in/right-in/right-out access
- Signalize the intersection of US Route 1 and Heritage Center Parkway
- Construct a northbound left turn lane on US Route 1 at the intersection of US Route 1/Heritage Center Parkway
- Construct a southbound right turn lane on US Route 1 at the intersection of US Route 1/Heritage Center Parkway
- Construct an eastbound right turn lane on Heritage Center Parkway at the intersection of US Route 1/Heritage Center Parkway

4.2.4 Russell Road DAR Improvements

This project will make improvements to Russell Road to accommodate the anticipated growth on MCB Quantico Westside. Under the assumption that US Route 1 would be widened from four to six lanes, the following draft recommendations were made in August 2011:

- Signalize the two existing unsignalized intersections with Russell Road and the US Route 1 ramps
- Reconfigure the Russell Road/US Route 1 northbound ramps intersection, including installation of a signal.
 - Concept 1 (preferred) - Implement a continuous-flow intersection where all movements except the eastbound through movement would be under signal control
 - Concept 2 - Construct a northbound to eastbound ramp in the southeast quadrant of the interchange to allow a free-flow merge onto Russell Road
- Widen Russell Road from two to four lanes between US Route 1 and Interstate 95 (I-95)

4.2.5 George Mason Drive Realignment

This project will realign the existing George Mason Drive (east of US Route 1) with a new entrance to Quantico Corporate Center (west of US Route 1). Design for this project has not been determined as of November 2012. Recommendations for this intersection presented in the Traffic Impact Analysis (TIA) for the Quantico Corporate Center are the following³:

- Construct the following on US Route 1
 - Dedicated southbound left-turn lane
 - Dedicated southbound right-turn lane
 - Dedicated northbound double left-turn lanes
- Construct the following on the eastbound new entrance to Quantico Corporate Center:
 - Dedicated eastbound left-turn lane
 - Eastbound shared through/right-turn lane
 - Dedicated eastbound right-turn lane
- Construct the following on the westbound realigned George Mason Road:
 - Dedicated left-turn lane
 - Shared through/right-turn lane

4.2.6 Telegraph Road DAR Improvements

This upcoming project will make improvements to Telegraph Road, west of US Route 1, to accommodate expected growth to MCB Quantico Westside. Design has not been determined but preliminary recommendations as of August 2012 included:

- Construct the following on eastbound Telegraph Road:

³ *Traffic Impact Analysis – Quantico Corporate Center & Corporate Drive Extension*. Kimley-Horn & Associates, Inc., February 2011. Recommendations presented in the TIA do not recommend a commitment from the developer to fund and/or construct improvements. All recommendations are presented with US Route 1 consisting of six lanes.

- Dedicated right-turn lane
 - Shared through/left-turn lane
- Construct the following on westbound Telegraph Road:
 - Dedicated right-turn lane
 - Shared through/left-turn lane

4.3 No-Build Conditions

No-build conditions for the opening year 2018 and horizon year 2040 consist of the improvements listed above and the forecast volumes detailed in **Chapter 2**. Lane configurations and traffic control for the no-build conditions are shown in **Figure 4-1**. Forecast volumes for 2018 can be found in **Figure 3-4** and **Figure 3-5** for the AM and PM volumes, respectively, and **Figure 3-6** and **Figure 3-7** for the horizon year 2040. The following are the signalized and unsignalized intersections along the study corridor⁴:

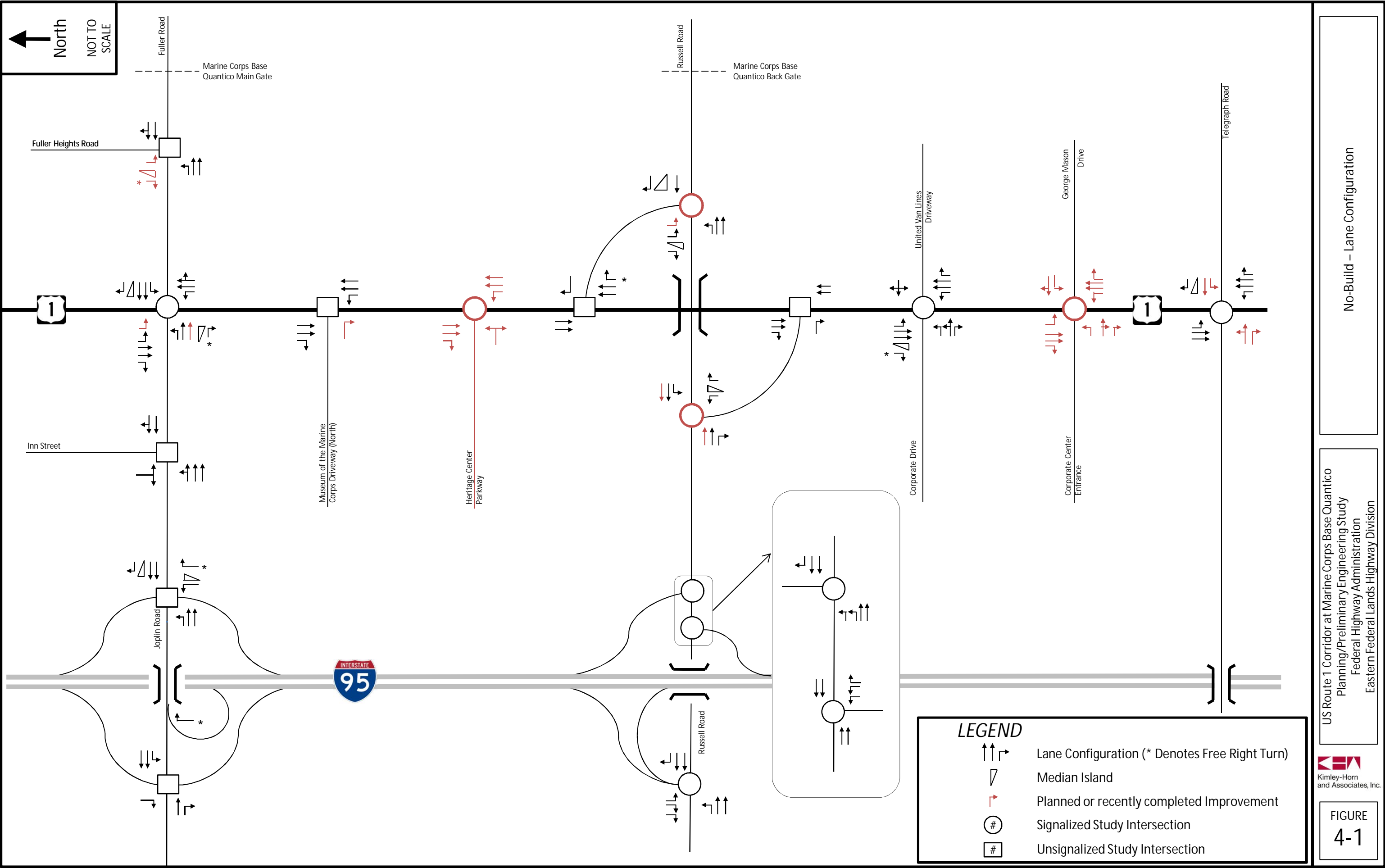
4.3.1 Signalized Intersections

- A. US Route 1/Joplin Road/Fuller Road*
- B. US Route 1/Heritage Center Parkway*
- C. Russell Road/US Route 1(Northbound) Ramps*
- D. Russell Road/US Route 1 (Southbound) Ramps*
- E. Russell Road/I-95 (Northbound) On Ramp
- F. Russell Road/1-95 (Northbound) Off Ramp
- G. Russell Road/I-95 (Southbound) Ramps
- H. US Route 1/Corporate Drive/United Van Lines Driveway
- I. US Route 1/George Mason Drive/Corporate Center Entrance*
- J. US Route 1/Telegraph Road*

4.3.2 Unsignalized Intersections

1. Fuller Road/Fuller Heights Road*
2. Joplin Road/Inn Street
3. Joplin Road/I-95 (Northbound) Ramps
4. Joplin Road/I-95 (Southbound) Ramps
5. US Route 1/Museum of the Marine Corps Driveway*
6. US Route 1 (Northbound)/Russell Road Ramps
7. US Route 1 (Southbound)/Russell Road Ramps

⁴ Intersections marked with an asterisk (*) are either new intersections or have been modified from the existing (2011) conditions



4.4 No-Build Intersection Capacity Analysis

4.4.1 Synchro/HCM Results

Intersection capacity analyses were performed using *Synchro*, Version 7, which uses methodologies in the *Highway Capacity Manual* (HCM), 2000 Edition for signalized and unsignalized intersections. The original Synchro networks used in the analysis were provided by the Virginia Department of Transportation (VDOT). In addition to modifying the laneage to represent no-build conditions, signal timings were optimized.

4.4.1.1 Signalized Intersections

Table 4-1 compares the overall level of service and vehicle delays for all signalized intersections in the study area in the 2018 and 2040 no-build scenarios to the existing peak hour conditions. The Synchro/HCM analysis shows that with 2018 no-build conditions, most signalized intersections operate at level of service (LOS) C or better, with the exception of US Route 1 and Joplin Road/Fuller Road, which operates at LOS F during the 2018 AM peak hour and LOS E in the PM peak hour. By 2040, the no-build conditions degrade significantly, with five of the 10 signalized intersections operating at overall level of service worse than D in the AM peak hours and eight in the PM peak hour. The PM delay is consistently worse than that of the AM, with eight of the 10 signalized intersections experiencing more than 120 seconds of delay during the PM peak hour. The following intersections operate at a level of service worse than D under 2040 no-build conditions:

- US Route 1/Joplin Road/Fuller Road – AM and PM peak hour
- Russell Road/US Route 1 (Northbound) Ramps – PM peak hour
- Russell Road/US Route 1 (Southbound) Ramps – PM peak hour
- Russell Road/I-95 (Northbound) On Ramp – PM peak hour
- Russell Road/I-95 (Southbound) Ramps – AM and PM peak hour
- US Route 1/Corporate Drive/United Van Lines Driveway – AM and PM peak hour
- US Route 1/George Mason Drive/Corporate Center Entrance – AM and PM peak hour
- US Route 1/Telegraph Road – AM and PM peak hour

Table 4-1: Summary of Existing 2011 and Future No-Build Intersection Capacity – Signalized Intersections (Synchro HCM Report)

Intersection	Existing		2018 No-Build		2040 No-Build	
	Level of Service	Delay, sec/veh	Level of Service	Delay, sec/veh	Level of Service	Delay, sec/veh
	AM (PM)	AM (PM)	AM (PM)	AM (PM)	AM (PM)	AM (PM)
US Route 1 and Joplin Road/Fuller Road	E (D)	70.8 (45.1)	F (E)	90.4 (67.2)	F (F)	165.1 (152.7)
Fuller Road and Fuller Heights Drive	-	-	B (B)	12.2 (13.5)	B (C)	13.6 (22.9)
US Route 1 and Heritage Center Parkway	-	-	A (A)	3.5 (9.9)	A (C)	3.9 (26.6)
Russell Road and US Route 1 (Northbound) Ramps	-	-	B (E)	11.3 (76.5)	B (F)	15.4 (321.5)
Russell Road and US Route 1 (Southbound) Ramps	-	-	B (B)	13.6 (19.5)	B (F)	16.6 (122.0)
Russell Road and I-95 (Northbound) On Ramp	A (B)	2.5 (15.7)	A (B)	1.6 (10.7)	A (F)	2.1 (144.9)
Russell Road and I-95 (Northbound) Off Ramp	A (A)	4.6 (0.9)	A (A)	8.2 (1.8)	A (B)	9.5 (16.6)
Russell Road and I-95 (Southbound) Ramps	C (B)	23.9 (19.3)	B (B)	19.9 (18.4)	C (F)	32.6 (251.8)
US Route 1 and Corporate Drive/Business Driveway	B (D)	15.1 (38.9)	B (D)	12.1 (38.8)	F (F)	102.6 (213.6)
US Route 1 and George Mason Drive/Corporate Center	-	-	A (B)	9.8 (14.3)	F (F)	117.4 (140.2)
US Route 1 and Telegraph Road (VA 637)	B (C)	18.4 (28.1)	C (C)	33.5 (34.0)	F (F)	186.7 (198.5)

4.4.1.2 Unsignalized Intersections

Table 4-2 summarizes the overall level of service and vehicle delays for all unsignalized intersections in the study area in the 2018 and 2040 no-build scenarios. In 2018, all unsignalized intersection approaches operate at LOS C or better during the AM peak hour, with the exception of the northbound exit ramp approach to Joplin Road/Fuller Road. During the PM peak hour, all approaches operate at

LOS C or better except for the right turn movement from the Russell Road ramp to southbound Route 1. Conditions are worse in the 2040 no-build scenario, with four of the seven unsignalized study intersections having approaches that operate at overall level of service worse than D in the AM peak hour and three in the PM peak hour. The following unsignalized intersection approaches operate at a level of service worse than D under 2040 no-build conditions:

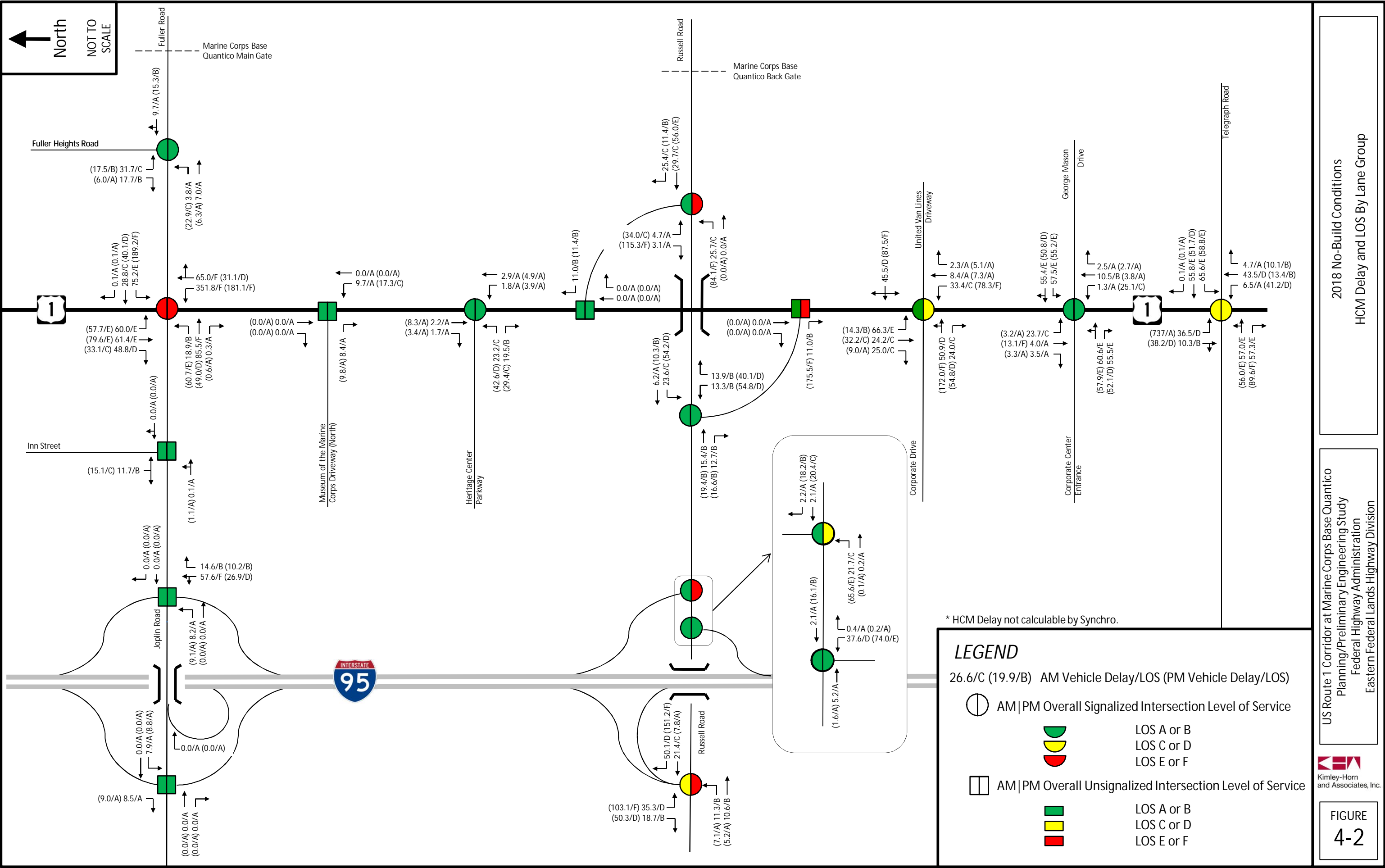
- Joplin Road/I-95 (Northbound) Ramps
 - Northbound on-ramp approach – AM and PM peak hours
- Joplin Road/I-95 (Southbound) Ramps
 - Southbound off-ramp loop approach – AM peak hour
- US Route 1 (Southbound)/Russell Road Ramps
 - Southbound off-ramp approach – AM and PM peak hours

A graphical summary of overall intersection level of service for opening year 2018, as well as vehicle delays and LOS by lane group, can be found in **Figure 4-2**. Results for horizon year 2040 are summarized in **Figure 4-3**. The Synchro HCM reports for 2018 and 2040 no-build are provided in Appendix E.

Table 4-2: Summary of Existing 2011 and Future 2040 No-Build Intersection Capacity - Unsignalized Intersections (Synchro HCM Report)

Intersection	Worst Approach	Existing		2018 No-Build		2040 No-Build	
		Approach LOS	Approach Delay sec/veh	Approach LOS	Approach Delay sec/veh	Approach LOS	Approach Delay sec/veh
		AM (PM)	AM (PM)	AM (PM)	AM (PM)	AM (PM)	AM (PM)
Joplin Road and Inn Street	SB	B (B)	10.5 (11.9)	B (C)	11.7 (15.1)	B (C)	12.7 (23.6)
Joplin Road and I-95 (Northbound) Ramps	Ramp	C (C)	20.7 (17.4)	F (D)	57.6 (26.9)	F (F)	Err* (Err)*
Joplin Road and I-95 (Southbound) Ramps	Ramp	B (B)	13.8 (11.0)	C (B)	22.4 (11.9)	F (D)	98 (30.7)
US Route 1 and Museum of the Marine Corps Dwy	EB	B (D)	12.4 (26.3)	A (A)	8.4 (9.8)	A (B)	8.9 (13.1)
US Route 1 (Northbound) and Russell Road Ramps	Ramp	B (A)	10.8 (9.2)	B (B)	11.0 (11.4)	B (C)	12.3 (15.8)
US Route 1 (Southbound) and Russell Road Ramps	Ramp	A (D)	8.9 (32.9)	B (F)	11.0 (175.5)	F (F)	155.7 (Err)*

* Delay exceeds the limits of the Highway Capacity Manual equations for an unsignalized intersection.



* HCM Delay not calculable by Synchro.

LEGEND

26.6/C (19.9/B) AM Vehicle Delay/LOS (PM Vehicle Delay/LOS)

⊖ AM|PM Overall Signalized Intersection Level of Service

⊖ LOS A or B
⊖ LOS C or D
⊖ LOS E or F

□ AM|PM Overall Unsignalized Intersection Level of Service

□ LOS A or B
□ LOS C or D
□ LOS E or F

4.5 No-Build Queue Analysis

4.5.1 Synchro Queue Analysis

Queue length reports were generated by Synchro 7 for each of the study intersections based on existing lane designations, traffic volumes, and truck percentages. The queue length reports show the 50th and 95th percentile queues for signalized intersections and the 95th percentile queue for unsignalized intersections. The 95th percentile queue represents the maximum vehicle queue length that would occur with 95th percentile traffic volumes and is typically used for planning purposes to determine the required length of a turn bay. The queue reports for years 2018 and 2040 are provided in Appendix E.

4.5.1.1 Signalized Intersections

Synchro queuing analysis of the no-build conditions focused on the 95th percentile queue lengths that exceeded the storage capacity at the signalized intersections. Expected vehicle queues for these left- and right-turn movements would extend back past the available storage of their respective turn bays and block the adjacent lane. This would create a potentially unsafe condition and further reduce the capacity of the intersection. The overcapacity through movements were also highlighted. Queues for these through movements will not clear every cycle and could potentially build throughout the peak period. Actual queue lengths may be even longer than predicted by Synchro equations.

Table 4-3 and **Table 4-4** list the turn movements that would have queues that exceed the storage length capacity and through movements over capacity in 2018 and 2040, respectively. Most study intersections had at least one overcapacity movement in the year 2018 results. By 2040, Synchro results predict that most left-turn and through movements will be overcapacity.

Table 4-3: 2018 No-Build Conditions Queuing Summary

Study Intersection	Turn Movement Queues that Exceed Available Storage Length	Through Movements Over Capacity
US Route 1/Joplin Road/Fuller Road	NBLT, WBLT	EB, SB
US Route 1/Heritage Center Parkway	-	-
Russell Road/US Route 1 (Northbound) Ramps	EBLT	WB
Russell Road/US Route 1 (Southbound) Ramps	NBLT	-
Russell Road/I-95 (Northbound) On Ramp	EBLT, WBRT	-
Russell Road/I-95 (Southbound) Ramp	WBRT	-
US Route 1/Corporate Drive	EBLT	-
US Route 1/Corporate Center Entrance/George Mason Drive	-	-
US Route 1/Telegraph Road	-	NB, SB

Table 4-4: 2040 No-Build Conditions Queuing Summary

Study Intersection	Turn Movement Queues that Exceed Available Storage Length	Through Movements Over Capacity
US Route 1/Joplin Road/Fuller Road	EBLT, WBLT, NBLT, SBLT	EB, WB, NB SB
US Route 1/Heritage Center Parkway	EBLT	SB
Russell Road/US Route 1 (Northbound) Ramps	EBLT, SBRT	WB
Russell Road/US Route 1 (Southbound) Ramps	WBLT, NBLT	WB
Russell Road/I-95 (Northbound) On Ramp	EBLT, WBRT	WB
Russell Road/I-95 (Southbound) Ramp	SBLT, SBRT, WBRT	-
US Route 1/Corporate Drive	EBLT, EBRT, NBLT	EB, WB, NB, SB
US Route 1/Corporate Center Entrance/George Mason Drive	EBLT, EBRT, WBLT, NBLT, SBLT	EB, NB, SB
US Route 1/Telegraph Road	EBLT, EBRT, WBLT, NBLT, SBLT	EB, NB, SB

4.6 Conclusions

The year 2018 traffic volumes indicate only a modest increase over existing levels. Most study intersections continue to operate at LOS C or better. The following intersections operate at LOS D or worse during at least one peak hour in 2018:

- US Route 1 and Joplin Road/Fuller Road – AM & PM peak
- Russell Road and US Route 1 Northbound ramps – PM peak
- US Route 1 and Corporate Drive – PM peak

Analysis of the 2040 conditions shows a further degradation of traffic conditions. Despite the approved roadway improvements that are assumed to be completed, eight of the ten signalized intersections operate at an LOS of D or worse during the AM or PM peak hours. Compared to the three intersections that experienced unacceptable overall levels of service during the existing conditions and in 2018, the 2040 no-build network presents significant delay increases and operation failures. The heaviest congestion is experienced during the PM peak hour, but the following intersections operate at an unacceptable LOS F during both peak periods:

- US Route 1 and Joplin Road/Fuller Road
- US Route 1 and Corporate Drive/ Business Driveway
- US Route 1 and George Mason Drive/Corporate Center Entrance
- US Route 1 and Telegraph Road

The Joplin Road intersection experienced increased delay from the already unacceptable LOS in the existing conditions and in 2018 no-build. The remaining three intersections are located in close proximity to the planned growth at Quantico Corporate Center, and will require further improvements to operate at an acceptable overall level of service.

The following unsignalized intersections have side street approaches that operate at LOS E or worse in either 2018 or 2040 according to Synchro analysis software:

- Joplin Road/I-95 (Northbound) Ramps (2018 and 2040)
- US Route 1 (Southbound)/Russell Road Ramps (2018 and 2040)
- Joplin Road/I-95 (Southbound) Ramps (2040 only)

Synchro analysis of 2018 conditions shows only minor changes in queue lengths over existing conditions. The 2040 no-build analysis results show that queue lengths increased greatly with the additional traffic projected. Nine intersections, compared to four in the existing conditions and seven in the 2018 no-build scenario, have at least one movement that experiences queue lengths exceeding the storage or lane group capacity for 95th percentile volumes. By 2040, most left-turn and through movements will be over capacity. Many of the intersections that experience excessive queue lengths are located along US Route 1. The through movement queues are highly directional with heavy northbound volumes during the AM peak period and heavy southbound volumes during the PM peak period.

The Synchro analysis indicates that with the completed and proposed roadway improvements along and surrounding US Route 1, most study intersections would continue to operate at acceptable levels of service through 2018. However, the roadway configurations cannot adequately handle the traffic demand generated by future developments in the US Route 1 corridor and projected growth at the MCB Quantico by the horizon year 2040. Additional signals or construction alternatives will be required to increase the operational capacity of the US Route 1 corridor and intersecting roadways.